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DEPARTMENT OF AGRICULTURE
U.S. Soil Conservation Service
Pacific Region

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Portland 4, Oregon
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TO : All soil survey personnel and others interested

FROM : S. W. Cosby, Regional Soil Scientist

Stanley Wallace, 1890-

SUBJECT: SOIL SURVEY - Timber production capacity and soils

FOREWORD

In Seattle, last March, the College of Forestry, University of Washington, and the Forest Soil Committee for the Douglas Fir Region, joined in a symposium on forest soils in forest management. It was the latest in a series of such gatherings of soils men and foresters and was designed to stimulate ideas, promote discussion and keep this important field of study in the forefront of local professional thinking.

One, among the many fine presentations at this symposium, was that offered by Don H. Baisinger, Research Forester, Crown Zellerbach Corporation. With Mr. Baisinger's permission, we reproduce it herewith for the benefit of you and others who did not have an opportunity to attend the Seattle symposium.

S. W. C.

18 March 1953

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HOW SOILS INFORMATION CAN AND SHOULD BE USED IN CLASSIFYING THE PRODUCTIVE CAPACITY OF FOREST LANDS //

by

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THE NEED FOR FULL PRODUCTIVITY AND FOR PRODUCTIVITY RATINGS

The concept of sustained yield production from timberlands through consciously applied forestry practices has long ceased to be just another theoretical principle. It is not only possible, economically, but essential.

Regional, national and international demands for wood, wood products, and for wood as a source of chemical raw materials, are increasing in a steepening curve. It is already apparent that sustained yield production is only a partial goal; it will be mandatory that timberlands produce to full sustained yield capacity. This is not just another abstract and trite expression. U.N.'s F.A.O. reports show vividly the worldwide imbalance between wood demand and wood supply.

The rate of cutting allowable today is determined by future rate of volume replacement by young stands. Ability to cut to full sustained yield capacity will obviously require maximum absolute growth rate.

Thus, it is no longer enough to know the actual production (or growth) of timberlands, but we must know:

1. Maximum production capabilities, and
2. How to obtain them.

In the final analysis, it is the soils which we manage, and trees are the crop which is produced. Properties of the forest soils in which

the trees are grown affect significantly the maximum production capabilities of forest lands.

The day may come when it may be both technically and economically possible to modify forest soil characteristics so that productivity can be increased, but we have other jobs to do first:

1. To find out what the productivity capabilities are now for different forest soils and different soil characteristics.

2. Determine management practices which use the full productive capacity of each site.

3. Determine management practices which maintain the full productive capacity of each site, and then

4. Determine management practices which improve the productive capacity of each site.

LIMITATIONS OF SITE INDEX

From T.B. 201: "Various combinations of the physical characteristics of forest areas, such as soil, drainage, rainfall, temperature, altitude, slope and aspect, result in different degrees of favorableness for tree growth. The combined effect of these characteristics on the stand is embraced in the term 'site' or 'site quality'." Normal yield tables measure this combined effect in terms of the "site index" - numerically equal to the average total height of dominant and codominant trees at 100 years of age. These indices are grouped for Douglas-fir into five "Site Classes," and heights for other ages have been determined for each index.

Site index as a measure of site quality doesn't tell us the part that each physical factor plays in determining what an area will produce,

though we know some of the many combinations which tend to make its productivity high or low. There are also other gaps in the site quality information given by site index:

1. It can't be measured in the absence of trees.
2. It will not necessarily be the same for the next rotation because of logging, burning, erosion, soil compaction, etc.
3. It may be different for other species.
4. There is evidence that some silvicultural practices affect height, as well as diameter, growth rates; existing site index tables may thus be inapplicable to stands under intensive management.
5. Normal yield tables (based on site index) do not give a satisfactory yardstick for stocking densities and productivity for stands under intensive management and/or at other than "full normal stocking." They don't tell how much the site has produced through its life.

Of the several physical site factors listed above, we can measure, in a given location, rainfall, temperature, altitude, slope, and aspect - and that leaves the soils.

FACTORS UPON WHICH PRODUCTIVITY AND PRODUCTIVITY RATINGS DEPEND

Productivities thus depend in part on physical factors other than soils such as climate, topography, and species. But for a given soil in a given location, we should be able to predict its productivity for various species, i.e.,

what volume per acre per year is it capable of producing over a rotation, in what type and size of material, under specific intensive management practices.

This rating will have to be in terms of species, stocking densities, and stand structure of various stand ages, and we must be able to identify

and classify our various forest soils accordingly. Soils of different characteristics may have the same high productivity - IF each is managed according to its needs.

In unmanaged natural stands, comparison of figures for mean annual yield with gross periodic annual increment, and comparison of stems per acre now with past figures, shows how far we have failed to utilize what the site has produced. If we thin at the right time, in the right amounts, by the right methods, and cut the right types of trees, we can save most of the mortality and double total stand yield over a rotation. Information from widely varying sources and many species shows that a given site has a certain maximum capacity for production in a given species. Short of actual site improvements, we will not exceed this capacity, but we can alter the type and size material of which the production is composed, and we can make use of all of the production. To realize the maximum productive capacity of the site, we must know what the optimum levels of growing stock are for stands which have been under intensive management for long periods. Heretofore, it has been necessary to "extrapolate" from data applicable to natural unmanaged stands. Recent silvicultural work now suggests methods by which we can determine and measure these optimum growing stock levels for stands, irrespective of their previous management history. We are now in a much better position to rate soils in terms of their true productivities, because we should be able now to determine what the true productivities are.

USE OF SOILS INFORMATION FOR CLASSIFYING PRODUCTIVE CAPACITY OF FOREST LANDS

To summarize, productive capacity of forest land depends on much

more than inherent physical, chemical, and biological characteristics of the soil, and I include here climatic and topographic situation. It depends also on:

1. Species,
2. Stand densities and structure throughout the rotation,
3. Silvicultural practices (times, amounts, methods, types of thinning),
4. Other management practices.

All of these factors are interdependent.

Productive capacity ratings for forest land must therefore be made in terms of the four general variables listed, as well as soils, so that for a given location, soil, and species, we can predict the yield in type and size of material under specific intensive management practices.

The first step is to correlate the various individual soil characteristics with productivity, and then the combinations. Much has already been accomplished along these lines. These correlations for a given characteristic or combination of characteristics will vary according to the four items above. Concurrently, a classification system for the soils will have to be developed, one as simple as possible while still giving the essential characteristics which determine productivity. In its initial form it will likely be rather general. Eventually, the system will probably be analagous to prefabricated building units; the basic outline will be for field use, based on visual soil characteristics and fairly broad productivity classes. This basic outline, plus detail obtainable from rapid laboratory examination of samples, will give a

breakdown of these broad productivity classes. These two units, plus data from more complete laboratory examination will give more refined and detailed yield ratings.

Some of the limiting characteristics, identified only by laboratory examination will probably occur over appreciable land areas. Once these characteristics are determined and the soils mapped for the forest property, field examination may be sufficient to fill in the other variables to give reasonably detailed productivity ratings.

Then our forest type maps will show productive capacity types, as well as existing forest cover, which are set up according to the management procedures required to use, maintain, and perhaps even to improve them.

This is not a new concept and there have already been significant accomplishments all along the line. You have heard some of them, and will hear of more during the rest of this symposium.

D. H. BAISINGER